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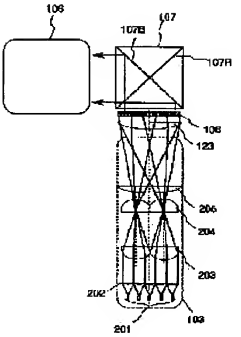
## (54) PROJECTION DISPLAY DEVICE

(57)Abstract:
PROBLEM TO BE SOLVED: To provide a projection display device which is devised to use plural semiconductor lasers as light sources having bright and high definition projection video with high availability of light.
SOLUTION: This device is provided with a semiconductor laser array 201 constituted of arranging plural semiconductor laser elements in matrix, a collimate lens array 202 collimating plural laser light, a two-dimensional optical modulator 106, a first lens plate 203 arranged with plural single lens parts, a second lens plate 204 arranged with plural single lens parts, a field lens 123 and a projection lens 108, and is constituted so that respective optical elements are arranged so that at least one among plural laser luminous flux made incident on the first lens plate 203 is emitted to adjacent single lens parts constituting the second lens plate 204 so as to range them.

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* NOTICES *



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CLAIMS

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[Claim(s)]
[Claim 1] In the projection mold display equipped with the light source section, the 2-dimensional light modulation equipment which modulates the flux of light outputted from the light source section according to image information, and forms an optical image, and the projector lens which projects said optical image on a screen side The laser array to which said light source section has arranged two or more semiconductor laser components in the shape of a matrix, The collimate lens array which makes parallel two or more laser light outputted from said laser array according to an individual, respectively, The 1st lens plate which has arranged two or more single lens sections to which the image display side and flat-surface configuration of said 2-dimensional light modulation equipment were similar in a field perpendicular to the main shaft of the laser flux of light outputted from said light source section, The 2nd lens plate which has arranged the single lens section of the same number as the single lens section of this 1st lens plate in a field perpendicular to the main shaft of the laser flux of light outputted from said light source section, It has the field lens arranged to the optical incidence side of said 2-dimensional light modulation equipment. The projection mold display characterized by being constituted so that at least one flux of light may be irradiated ranging over between the ****** single lens sections of said 1st lens plate among two or more laser flux of lights which carry out incidence to said 1st lens plate.
[Claim 2] In a projection mold display equipped with the light source section, the 2-dimensional light modulation equipment which modulates the flux of light outputted from the light source section according to image information, and forms an optical image, and the projector lens which projects said optical image on a screen side The laser array to which said light source section has arranged two or more semiconductor laser components in the shape of a matrix, The collimate lens array which makes parallel two or more laser light outputted from said semiconductor laser array according to an individual, respectively, The 1st lens plate which has arranged two or more single lens sections to which the image display side and flat-surface configuration of said 2-dimensional light modulation equipment were similar in a field perpendicular to the main shaft of the laser flux of light outputted from said light source section, It has the field lens arranged to the optical incidence side of said 2-dimensional light modulation equipment. The center of curvature of each single lens section of said 1st lens plate, The aspect ratio of the discrepancy based on [ of the laser flux of light group outputted from said light source section ] main shafts Among two or more laser flux of lights which are the same as the height of the display of said 2-dimensional light modulation equipment, and the ratio of width of face, and carry out incidence to said 1st lens plate, at least one flux of light The projection mold display characterized by being constituted so that it may irradiate ranging over between the ****** single lens sections of said 1st lens plate.
[Claim 3] In invention of claim 1 or claim 2 the width of face of each single lens section of said 1st lens plate W, two or more laser flux of lights which set height to H and carry out incidence to said 1st lens plate -- this -- the pitch of the cross direction on the 1st lens plate, when the pitch of Ph and the height direction is set to Pv W=Ph(Nh+Khl/Kh) H=Pv Nh (Nv+Kvl/Kv), The relation of the multiplier which consists of an integer of arbitration smaller than multiplier Kvl:Kv which consists of an integer of arbitration smaller than multiplier Khl:Kh which consists of a multiplier Kh which consists of an integer of the arbitration beyond Nv:0, and an integer of the arbitration beyond Kv:1 is realized. And the projection mold display with which the number of the cross direction of each single lens section of said 1st lens plate is characterized by the integral multiple of a multiplier Kh and the number of the height direction being the integral multiples of a multiplier Kv.
[Claim 4] The projection mold display characterized by consisting of three or more kinds of semiconductor laser components which emit the laser light in which said laser array has different main wavelength in invention of

claim 1 or claim 2, and connecting this laser array and said 2-dimensional light modulation equipment to an image control unit.
[Claim 5] The projection mold display characterized by for said 2-dimensional light modulation equipment forming a mirror on a semiconductor chip, and consisting of liquid crystal display components of the reflective mold incorporating liquid crystal, and being constituted in invention of claim 1 or claim 2 so that it may display using the birefringence effectiveness.

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DETAILED DESCRIPTION

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[Detailed Description of the Invention]
[0001]
[The field of the invention to which invention belongs] This invention relates to the image display device which projects and displays on a screen the image displayed on 2-dimensional light modulation equipment, especially relates to the projection mold display using a liquid crystal display component.
[0002]
[Description of the Prior Art] although there is a liquid crystal projector of the light valve method using the liquid crystal display component as an example of a projection mold indicating equipment, this liquid crystal projector has the advantage acquired and said, when it is a small light weight, the consideration to the effect of earth magnetism is not required as compared with the indicating equipment which used CRT (cathode-ray tube) but a big screen image is acquired easily.
[0003] And the so-called TN (Twisted Nematic) liquid crystal display component from which the dielectric anisotropy enclosed 90 degrees of forward nematic liquid crystals in the distorted condition continuously [ a liquid crystal molecule major axis ] between two glass substrates as a liquid crystal display component of this liquid crystal projector, for example between two glass substrates which have a transparent electrode is known.

[0004] On the other hand, apart from the liquid crystal display component of such a transparency mold, the display which the liquid crystal display component of the reflective mold which incorporated liquid crystal there is also known, and uses the ECB (ElectricallyContorlled Birefringence) effectiveness as a projection mold display using this reflective type of component, controls [ a light reflex side is formed on a semiconductor chip, and ] the polarization condition of light, and forms an image is proposed by JP,64-7021,A.
[0005] By the way, although the light source for incident light is needed in such a projection mold display of a light valve method, generally high intensity discharge lamps, such as a metal halide lamp and a xenon lamp, are used as this light source with the conventional technique.
[0006]
[Problem(s) to be Solved by the Invention] Consideration was not carried out about the following technical problems depended on having used high intensity discharge lamps, such as a metal halide lamp and a xenon lamp, as the light source, but the above-mentioned conventional technique had a problem in respect of energy saving.
[0007] Although such a display takes the light source in three primary colors for color display, since high intensity discharge lamps, such as a metal halide lamp and a xenon lamp, are generally close to the source of the white light, it is necessary to carry out a spectrum to the three primary colors with a dichroic mirror etc. but, and since broadcloth [ in such a source of the white light / a spectrum ], in order to use light efficiently in this case, it is desirable to make the wavelength band of the light of each color large as much as possible.
[0008] However, if it does so, the color purity of the light source will fall and the reappearance range of a color will become narrow. Moreover, with the liquid crystal display component using ECB mode, for the wavelength dispersion of a liquid crystal layer, a chromaticity shifts and produces the problem of it becoming impossible to perform stable color reproduction with the brightness (electrical potential difference impressed to liquid crystal) of a display.
[0009] Furthermore, in the display device for which the light from this kind of light source uses polarization, such as TN liquid crystal display component and an ECB reflective mold liquid crystal display component, for unpolarized light, at least, in order to absorb a half light with a polarizing plate etc. and to throw away, efficiency

for light utilization will become still lower. Therefore, with the above-mentioned conventional technique, in order to obtain a bright display, the light source with much quantity of light will be needed, and a problem will arise in respect of energy saving.

[0010] by the way, laser can be considered as the light source without such a problem, and semiconductor laser is remarkably small as compared with solid state laser, gas laser, etc. especially -- it is strong and, moreover, efficient and mass production method are possible -- etc. -- since it has the advantage, it is especially promising. However, semiconductor laser cannot say it as sufficient output, in order an output is now as low as about several mW and to use as the light source of a projection mold display alone.

[0011] Then, although it is possible to obtain the required quantity of light by using two or more semiconductor laser, and control of luminous-intensity unevenness becomes a technical problem in this case, with the conventional technique, reference is not made at all. The purpose of this invention is to offer the projection mold display with which the bright high-definition projection image was acquired, using two or more semiconductor laser as the light source.

[0012]

[Means for Solving the Problem] In the projection mold display equipped with the 2-dimensional light modulation equipment which the above-mentioned purpose modulates the flux of light outputted from the light source section and the light source section according to image information, and forms an optical image, and the projector lens which projects said optical image on a screen side The laser array to which said light source section has arranged two or more semiconductor laser components in the shape of a matrix, The collimate lens array which makes parallel two or more laser light outputted from said laser array according to an individual, respectively, The 1st lens plate which has arranged two or more single lens sections to which the image display side and flat-surface configuration of said 2-dimensional light modulation equipment were similar in a field perpendicular to the main shaft of the laser flux of light outputted from said light source section, The 2nd lens plate which has arranged the single lens section of the same number as the single lens section of this 1st lens plate in a field perpendicular to the main shaft of the laser flux of light outputted from said light source section, It has the field lens arranged to the optical incidence side of said 2-dimensional light modulation equipment, and among two or more laser flux of lights which carry out incidence to said 1st lens plate, it irradiates ranging over between the ****** single lens sections of said 1st lens plate, and at least one flux of light makes, and is attained.

[0013] Moreover, the above-mentioned purpose modulates the flux of light outputted from the light source section and the light source section according to image information, and sets it to a projection mold display equipped with the 2-dimensional light modulation equipment which forms an optical image, and the projector lens which projects said optical image on a screen side. The laser array to which said light source section has arranged two or more semiconductor laser components in the shape of a matrix, The collimate lens array which makes parallel two or more laser light outputted from said semiconductor laser array according to an individual, respectively, The 1st lens plate which has arranged two or more single lens sections to which the image display side and flat-surface configuration of said 2-dimensional light modulation equipment were similar in a field perpendicular to the main shaft of the laser flux of light outputted from said light source section, It has the field lens arranged to the optical incidence side of said 2-dimensional light modulation equipment. The center of curvature of each single lens section of said 1st lens plate, The aspect ratio of the discrepancy based on [ of the laser flux of light group outputted from said light source section ] main shafts It is the same as the height of the display of said 2-dimensional light modulation equipment, and the ratio of width of face, and among two or more laser flux of lights which carry out incidence to said 1st lens plate, even if it makes it at least one flux of light irradiated ranging over between the ****** single lens sections of said 1st lens plate, it is attained.

[0014] two or more laser flux of lights which set width of face of each single lens section of said 1st lens plate to W, set height to H, and carry out incidence to said 1st lens plate further at this time -- this -- the pitch of the cross direction on the 1st lens plate, when the pitch of Ph and the height direction is set to Pv W=Ph (Nh+Khl/Kh) H=Pv Nh (Nv+Kvl/Kv), The relation of the multiplier which consists of an integer of arbitration smaller than multiplier Kvl:Kv which consists of an integer of arbitration smaller than multiplier Khl:Kh which consists of a multiplier Kh which consists of an integer of the arbitration beyond Nv:0, and an integer of the arbitration beyond Kv:1 is realized. And the number of the cross direction of each single lens section of said 1st lens plate is attained also when making it the integral multiple of a multiplier Kh and the number of the height direction become the integral multiple of a multiplier Kv.

[0015] After the laser flux of light outputted from the semiconductor laser component of a laser array by the

above-mentioned configuration is changed into parallel light by the collimate lens array, incidence of it is carried out to the 1st lens plate. Under the present circumstances, among two or more laser flux of lights which carry out incidence to the 1st lens plate, a part of laser flux of lights come to be irradiated so that the ****** single lens section which constitutes the 1st lens plate may be straddled.

[0016] Here, the transfer superposition of the laser flux of light which passed each single lens section of the 1st lens plate is carried out at the display of 2-dimensional light modulation equipment through the single lens section and the field lens with which the 2nd lens plate corresponds, respectively.

[0017] At this time, the laser flux of light group which passed one certain single lens section serves as periodic optical intensity distribution which have the peak of optical reinforcement in the location corresponding to the pitch of semiconductor laser on a 2-dimensional light modulation equipment display. However, the peak location of the optical reinforcement of the laser flux of light group which passed the same line or the single lens section of the same train can be appropriately shifted with the value of multipliers Kh and Kv, and thereby, the gap of the laser flux of light group which passed a certain single lens section can be irradiated so that the laser flux of light group which passed another single lens section may be compensated, and it can make the optical intensity distribution after composition homogeneity in a field in it.

[0018] Moreover, since the configurations of the single lens section which constitutes the 1st lens plate are the configuration of the display of 2-dimensional light modulation equipment, and similarity, the cross-section configuration of the laser flux of light group after composition can perform high lighting of the effectiveness which serves as the shape of a display and isomorphism and does not have excess and deficiency.

[0019] Therefore, according to the projection mold display of this invention, since the laser light from two or more semiconductor laser is compounded and used as illumination light, the projection image of sufficient brightness can be obtained.

[0020] Moreover, since there is almost no loss of the light by the mismatch of the illumination light and the configuration of the display of 2-dimensional light modulation equipment, efficiency for light utilization is high and a bright projection image is acquired. Furthermore, since the optical intensity distribution of the laser flux of light group after composition become uniform, a projection image uniform [ the brightness within a field ] and high-definition is acquired.

[0021] Moreover, when using a liquid crystal display component as 2-dimensional light modulation equipment, for the ** reason which can press down loss by a polarizing plate etc. small by arranging the sense of polarization of the linearly polarized light light outputted from each semiconductor laser towards desired, efficiency for light utilization improves and a brighter projection image is acquired.

[0022] And since a high light of the narrow color purity of a wavelength band can obtain the semiconductor laser which is the light source, its color reproduction range is wider than the case where the conventional source of the white light is used, and it can acquire a high-definition projection image.

[0023]

[Embodiment of the Invention] Hereafter, the operation gestalt of illustration explains the projection mold display by this invention to a detail. Drawing 1 is the basic block diagram of the optical system of the projection mold display by 1 operation gestalt of this invention. This projection mold display To the 2-dimensional light modulation equipment 104 for (red R) of the transparency mold arranged on three side faces of this dichroic prism 107 centering on the dike lock prism 107, respectively, the 2-dimensional light modulation equipment 105 for (Green G), and it, the 2-dimensional light modulation equipment 106 for (blue B), It has the projector lens 108 arranged near the one remaining side face.

[0024] furthermore, to these 2-dimensional light modulation equipments 104, 105, and 106 The semiconductor laser light equipment 101, 102, and 103 which irradiates the laser light of a color which corresponds, respectively, and the field lenses 121, 122, and 123 are formed. By this Incidence of the blue light to the red which carried out outgoing radiation from semiconductor laser light equipment 101, 102, and 103, green, and it is carried out to the 2-dimensional light modulation equipments 104, 105, and 106 for colored light which correspond through the field lenses 121, 122, and 123, respectively.

[0025] Here these 2-dimensional light modulation equipments 104, 105, and 106 It is equipment which modulates the light which carried out incidence according to the image information of each color, for example, consists of liquid crystal display components of a transparency mold. Specifically Between two glass substrates with which the transparent electrode which forms a pixel was given, a dielectric anisotropy encloses a forward nematic liquid crystal. At this time It consists of so-called TN (Twisted Nematic) liquid crystal display components from which it was made for 90 degrees of liquid crystal molecule major axes to be in a distorted

condition continuously between two glass substrates.
[0026] And this TN liquid crystal display component is arranged between two polarizing plates which made the polarization shaft intersect perpendicularly, and controls the amount of transparency of light by controlling a polarization condition. At this time, the so-called active matrix which prepared the thin film transistor (TFT) for every pixel can be used as this liquid crystal display component.
[0027] After becoming irregular for every pixel according to the image information of each color, incidence of the light which carried out incidence to these 2-dimensional light modulation equipments 104, 105, and 106 is carried out to a dichroic prism 107. This dichroic prism 107 makes four prism of 3 prismatic forms which has red-reflex film 107R and blue reflective film 107B combination, and tension 4 in all prismatic forms so that red-reflex film 107R and blue reflective film 107B may intersect perpendicularly mutually and may be formed in those cladding sides.
[0028] And to this dichroic prism 107, first, as the 2-dimensional light modulation equipment 104 for red counters with red-reflex film 107R, it is arranged on that side face, and next, as the 2-dimensional light modulation equipment 106 for blue faces the 2-dimensional switching equipment 104 for red, it is arranged on the side face of ********.
[0029] On the other hand, the travelling direction of the reflected light according [ the 2-dimensional light modulation equipment 105 for green ] to red-reflex film 107R and blue reflective film 107B of a dichroic prism 107 is arranged on the side face of the opposite side. And the projector lens 108 is arranged near the side face in the travelling direction of the reflected light by red-reflex film 107R and blue reflective film 107B of this dichroic prism 107.
[0030] The modulation light which passed the 2-dimensional light modulation equipment 104 for red by this The modulation light which was reflected by red-reflex film 107R of a dichroic prism 107, and passed the 2-dimensional light modulation equipment 106 for blue It is reflected by blue reflective film 107B, and incidence is carried out to a projector lens 108, respectively. The modulation light which was projected by the screen 109 with this projector lens 108, and passed the 2-dimensional light modulation equipment 105 for green Red-reflex film 107R of a dichroic prism 107 and blue reflective film 107B are penetrated as it is, incidence is carried out to a projector lens 108, and it is projected by the screen 109.
[0031] Consequently, red and each green and blue modulation light will be compounded with a dichroic prism 107, it will be projected on a screen 109 with a projector lens 108, and a full color expansion image will be displayed on a screen 109.
[0032] Next, the semiconductor laser light equipment 101, 102, and 103 which is the principal part of this invention is explained. In addition, these of the configuration of the whole optical system are the same, and since the luminescent color of the semiconductor laser used as the light source only differs, by the following explanation, blue semiconductor laser light equipment 103 is mentioned as an example, and they explain it.
[0033] The semiconductor laser array 201 which has arranged two or more semiconductor laser components which drawing 2 is the basic block diagram of blue semiconductor laser light equipment 103, and generate a blue laser light first in the shape of a matrix in the same field, It has two or more convex lens sections arranged in the shape of a matrix corresponding to each of each semiconductor laser of this semiconductor laser array 201. It has the collimate lens array 202 for carrying out parallel Guanghua of two or more laser light outputted from each of each semiconductor laser component according to an individual, respectively, and let this be the light source section.
[0034] Next, the sequential array of these has been carried out toward the field lens 123 and 2-dimensional light modulation equipment 106 using the 3rd lens 205 which serves as the 1st lens plate 203 which makes it come to arrange two or more convex lens sections, and the 2nd lens plate 204 from the single convex lens section into the field perpendicular to the main shaft of the flux of light outputted from this light source section.

[0035] Thereby, after two or more laser light first outputted from the semiconductor laser array 201 is separately changed by the collimator lens array 202 at the parallel flux of light, respectively, incidence of them is carried out to the 1st lens plate 203 by it.
[0036] The lens plate 203 of these 1st and the 2nd lens plate 204 have the single lens section of same number isomorphism, respectively, the single lens section of the 1st lens plate 203 and the single lens section of the 2nd lens plate 204 are made to correspond to 1 to 1, respectively, thereby, the image near [ where the 1st lens plate 203 corresponds ] the single lens is overlapped on the display of 2-dimensional light modulation equipment 106, and image formation is made to be carried out.

[0037] Here, this 1st lens plate 203 serves to raise the transmission efficiency of light with the 2nd lens plate 204 and the 3rd lens plate 205, and, for this reason, has the composition of having allotted the single lens section of two or more rectangles made by the display and analog of 2-dimensional light modulation equipment 106 in the shape of a matrix.
[0038] And the focal distance of each single lens section of this 1st lens plate 203 is made almost equal to the distance between the 1st lens plate 203 and the 2nd lens plate 204, and, thereby, the parallel flux of light by which incidence is carried out to each single lens section of the 1st lens plate 203 is made to be condensed on the single lens section to which the 2nd lens plate 204 corresponds.
[0039] Therefore, the single lens section of the 2nd lens plate 204 carries out image formation of the image near the single lens section of the 1st corresponding lens plate 203 to infinite distance. Then, in order that the 3rd lens plate 205 may carry out the transfer superposition of the image which should be formed in infinite distance with the 2nd lens plate 204 at the display of 2-dimensional light modulation equipment 106, the focal distance is almost equal to the distance of the 3rd lens plate 205 and 2-dimensional light modulation equipment 106.
[0040] Furthermore, in order to transmit the image near the single lens section of the 1st lens plate 203 to the display of 2-dimensional light modulation equipment 106 the neither more nor less, the dilation ratio with the 2nd lens plate 204 and the 3rd lens plate 205 is made to have corresponded to the ratio of the magnitude of the single lens section of the 1st lens plate 203, and the magnitude of the display of 2-dimensional light modulation equipment 106.
[0041] Next, although the field lens 123 is formed in the flux of light incidence side of 2-dimensional light modulation equipment 106 like illustration Since the illumination-light bundle by which incidence of this is carried out to 2-dimensional light modulation equipment 106 from the 2nd lens plate 204 is the emission flux of light, It is arranged in order to make this parallel and to carry out incidence, and for this reason, the focal distance of this field lens 123 is made almost equal to the distance between the 2nd lens plate 204 and the field lens 123.
[0042] In addition, although the field lens 123 is constituted from this operation gestalt by the plano-convex lens which turned the flat surface to the 2-dimensional light modulation equipment 106 side, a biconvex lens, the plano-convex lens which turned the convex to 2-dimensional light modulation equipment 106, a Fresnel lens, an aspheric lens, etc. can be used.
[0043] The flux of light which passed each single lens section which constitutes the 1st lens plate 203 will be superimposed and transmitted to the display of 2-dimensional light modulation equipment 106 the above result through the 2nd lens plate 204, the 3rd lens plate 205, and the field lens 123.
[0044] Next, the configuration of each lens plate in this operation gestalt is explained. First, drawing 3 is what showed the transverse-plane configuration of the 1st lens plate 203, like illustration, it has the four single lens sections 203a, 203b, 203c, and 203d, and such single lens section 203a - a flat-surface configuration are made from this operation gestalt by the configuration and analog of a display of the 2-dimensional light modulation equipment 106 which consists of a rectangle of an aspect ratio 4:3.
[0045] And thereby, outgoing radiation is carried out from each laser component of the semiconductor laser array 201, and on this 1st lens plate 203, the cross-section configuration of the laser flux of light made parallel by the collimate lens array 202 becomes an ellipse form, as a graphic form 301 shows.
[0046] Next, drawing 4 is what showed the transverse-plane configuration of the 2nd lens plate 204 in this operation gestalt, and is equipped with the lens section of the 1st lens plate 203, and the single lens sections 204a, 204b, 204c, and 204d of same number isomorphism like illustration. Therefore, each single lens section 203a of the 1st lens plate 203 shown in drawing 3 - an image are condensed, and the reduced graphic form 401 comes to show the cross-section configuration of the laser flux of light group on this 2nd lens plate 204.
[0047] Here, in the projection mold display by this invention, it is characterized by constituting so that it may irradiate ranging over the ****** single lens section from which at least one of two or more laser flux of lights which carry out incidence to the 1st lens plate 203 constitutes the 1st lens plate 203 as shown, for example in the above-mentioned operation gestalt. As shown in drawing 3 , when it sets width of face of each single lens section of the 1st lens plate 203 to W and the pitch of Ph and the height direction is specifically set [ height ] to Pv for the pitch of the cross direction on the 1st [ of H and a laser flux of light group ] lens plate, it is made for the following relation to be materialized.
[0048] W=Ph(Nh+Khl/Kh) H=Pv Nh (Nv+Kvl/Kv), Nv: At the multiplier which consists of an integer of arbitration smaller than multiplier Kvl:Kv which consists of an integer of arbitration smaller than multiplier Khl:Kh which

consists of a multiplier Kh which consists of an integer of the arbitration beyond 0, and an integer of the arbitration beyond Kv:1, and this time The number of the cross direction of the single lens section which constitutes the 1st lens plate 203 is the integral multiple of a multiplier Kh, and it is made for the number of the height direction to serve as an integral multiple of a multiplier Kv.

[0049] Although the laser flux of light group which passed each single lens section of the 1st lens plate 203 is transmitted and the single lens section to which the 2nd lens plate 204 corresponds, respectively, the 3rd lens plate 205, and it are overlapped on it through the field lens 206 at the display of 2-dimensional light modulation equipment 106 as described above When it sees about the laser flux of light group which passed one certain single lens section in the 1st lens plate 203 at this time On the display of 2-dimensional light modulation equipment 106, it becomes the periodic optical intensity distribution which have the peak of optical reinforcement in the location corresponding to the pitch of semiconductor laser, and does not become uniform brightness in a field.

[0050] However, by this invention, the peak location of the optical reinforcement of the laser flux of light group which passed the same line or the single lens section of the same train can be appropriately shifted by specifying the incidence location to the 1st lens plate of the laser flux of light as above-mentioned. For example, with the operation gestalt shown in drawing 3 , since it is made Nh=Nv=Kh=Kv=2, a part of laser flux of lights are irradiated ranging over the single lens section which adjoins each other every [ 2 / 1/] among two or more laser flux of lights which carry out incidence to the 1st lens plate 203.

[0051] In this case, the laser flux of light group which passed the single lens section which adjoins crosswise [ of the 1st lens plate 203 ] For the laser flux of light group which passed the single lens section to which the peak location of optical reinforcement adjoins each other in 1 / 2 pitch gap, and the height direction crosswise mutually on the display of 2-dimensional light modulation equipment 106, the peak location of optical reinforcement is 1 / 2 pitch ****** to the height direction mutually on the display of 2-dimensional light modulation equipment 106. For this reason, as shown in drawing 5 , the laser flux of light group which passed each lens plate is compounded so that each clearance may be compensated mutually.

[0052] This drawing 5 is what showed the display of 2-dimensional light modulation equipment 106 as 501. Since the configuration of the single lens section of the 1st lens plate 203 is made into the configuration and analog of a display (inside frame) 501 of this 2-dimensional light modulation equipment 106 as above-mentioned, The cross-section configuration after composition of the laser flux of light group (outside frame) 502 which passed each single lens section can be made into the same rectangle configuration as a display 501, and it is superimposed on each laser flux of light, and as each clearance is compensated mutually, it can irradiate.

[0053] That is, since according to this invention the cross-section configuration of the laser flux of light after composition turns into the same configuration as a display and it is superimposed mutually, the high lighting of effectiveness without excess and deficiency is obtained. Drawing 6 is drawing having shown the optical intensity distribution in the A-A location of drawing 5 , and this drawing 6 explains it in more detail hereafter.

[0054] Since the luminous-intensity distribution outputted from each semiconductor laser component is generally presenting Gaussian distribution, the laser flux of light group which passed the single lens section of the 1st lens plate 203 serves as periodic distribution which has a peak in the location resulting from the pitch of arrangement of semiconductor laser only by seeing for every single lens section, as shown in drawing 6 .

[0055] the peak location of the optical reinforcement of the laser flux of light group which carried out the deer, and passed single lens 203a of the adjacent single lens section, for example, drawing 3 , and single lens section 203b according to semiconductor laser light equipment 103 -- mutual -- 1 / 2 pitch gap ********** -- since it is made like, as shown in drawing 6 , on the display 501 of 2-dimensional light modulation equipment 106, it becomes a synthetic light of uniform intensity distribution.

[0056] Therefore, since the display 501 of 2-dimensional light modulation equipment 106 was efficiently illuminated to homogeneity using the semiconductor laser array 201 which consists of two or more semiconductor laser components according to the operation gestalt of this invention, in spite of having used two or more semiconductor laser components as the light source of a projection mold display, enough bright moreover, a high-definition projection image can be acquired easily.

[0057] Here, as described above, the number of single lens section 203a which constitutes the 1st lens plate 203 - the cross direction is the integral multiple of a multiplier Kh, and the number of the height directions should just be the integral multiple of a multiplier Kv. This is because the field where it is formed crosswise by Kh individual and it is formed in the height direction in the single lens section of Kv individual turns into a unit field for performing homogeneity lighting. The field where it follows, for example, the number of the single lens

sections will be formed crosswise by two pieces, and will be formed in the height direction with two pieces and a total of four single lenses if it is Kh=Kv=2 turns into a unit field.
[0058] Drawing 7 is other 1 operation gestalten of the 1st lens plate 203, and the ellipse graphic form 301 is the cross-section configuration of the laser flux of light group on this 1st lens plate 203. About the above-mentioned multiplier, after being referred to as Kh=Kv=2, the operation gestalt of this drawing 7 The 1st lens plate 203 at the time of making the cross direction and the height direction into the number of 2 twice of multipliers Kh and Kv, i.e., the 16 single lens sections, is shown [ therefore ]. In the example of this drawing 7 For example, the field 702 which consists of the four single lens sections enclosed with a thick frame turns into a unit field for performing homogeneity lighting.
[0059] Therefore, as compared with the operation gestalt which will be equipped with four unit fields, consequently was shown in drawing 3 , the 1st lens plate 203 by this operation gestalt can increase the number of semiconductor laser components 4 times, and, thereby, can acquire the projection image of one 4 times the brightness of this.
[0060] Moreover, with the projection mold display by this invention, the capacity of the light source, i.e., the brightness of a projection image, is easily changeable from this with the change in the number of a unit field, and the number of a semiconductor laser component which constitutes the 1st lens plate 203. Therefore, the projection mold display of desired brightness can be easily obtained from the requirement specification over the output per semiconductor laser component, and the brightness of a projection image by computing the number of the semiconductor laser component to need and designing optical system according to this number.
[0061] next , drawing 8 be other operation gestalten of the 1st lens plate 203 , and about the above-mentioned multiplier , after being refer to as Kh=Kv=3 , like illustration , three pieces be prepare in the height direction , and this example prepare a total of nine three - piece and single lens sections 802a- crosswise , and , thereby , carry out it as [ become / a unit field for these nine single lens sections to perform homogeneity lighting ] .
[0062] Therefore, the sectional view form 301 of the laser flux of light on this 1st lens plate 203 In a unit field, like illustration, after one third has straddled, it is superimposed [ consequently ]. With the operation gestalt of this drawing 8 The laser flux of light which passed each single lens section 802a- which constitutes the 1st lens plate 203 As opposed to the peak location of the optical reinforcement of the laser flux of light group which passed a certain single lens section when superimposed on the display of 2-dimensional light modulation equipment 106 By the laser flux of light group which passed another single lens section, 1/of peak locations of optical reinforcement shifts in the height direction 3 pitch 1/3 pitch and crosswise, respectively.
[0063] Drawing 9 is drawing having shown distribution of the optical reinforcement in the display of the 2-dimensional light modulation equipment 106 when using the 1st lens plate 203 shown in drawing 8 . As already explained, the laser flux of light which passed the one single lens section becomes the periodic optical intensity distribution which have a peak in the location resulting from the pitch of arrangement of a semiconductor laser component.
[0064] However, with the operation gestalt of this drawing 8 , since, as for the laser flux of light group which passed the same line or the same single lens section 802a, 802b, and 802c of a train, for example, the single lens sections, 1/3 pitch of peak locations of luminous intensity has shifted at a time, the luminous-intensity distribution after that composition becomes homogeneity, as shown in drawing 9 as a synthetic light. Therefore, the display of 2-dimensional light modulation equipment 106 can be illuminated to homogeneity the neither more nor less also according to the operation gestalt of this drawing 8 .
[0065] Although the amount of gaps of the optical on-the-strength peak location where the optical intensity distribution after composition of the laser flux of light group which passed each single lens section become homogeneity here changes with optical intensity distributions which the one laser flux of light has In this invention, the amount of gaps of the peak location of the laser flux of light group on a 2-dimensional light modulation equipment display So that the optical intensity distribution after compounding the amount of gaps of the peak location of the optical reinforcement of the laser flux of light group which passed each single lens section since it can set to arbitration with the value of multipliers Kh and Kv may become homogeneity most The optimal homogeneity lighting can be easily obtained by defining the value of multipliers Kh and Kv.
[0066] Drawing 10 is other operation gestalten of semiconductor laser light equipment 103, is replaced with the 2nd lens plate 204 and the 3rd lens plate 205 in the operation gestalt of drawing 2 , and forms the 2nd lens plate 1001. One field (drawing lower field) like illustration this 2nd lens plate 1001 The spherical surface, Or it is the thing which it is [ thing ] the convex which has the condensing operation which consists of the aspheric surface, and made the convex of the same number corresponding to the single lens section which constitutes

the 1st lens plate 203 form in the field of another side in the shape of a matrix. Thereby, the function of the both sides of the 2nd lens plate 204 in the operation gestalt of drawing 2 and the 3rd lens plate 205 is obtained.

[0067] Therefore, according to the operation gestalt of this drawing 10 , components mark can be reduced as compared with the operation gestalt of drawing 2 . In addition, in this drawing 10 , although the 2nd lens plate 1001 has turned to the 2-dimensional light modulation equipment 106 side the field in which the matrix-like lens section is formed, it may be turned to the 1st lens plate 203 side on the contrary.
[0068] Drawing 11 is still more nearly another operation gestalt of semiconductor laser light equipment 103. In drawing, the 1st lens plate 1103 consists of convexes of two or more shape of a single lens with which one field (drawing upper field) was located in a line in the shape of a matrix, and is formed in the single convex which has the condensing operation which the field of another side becomes from the spherical surface or the aspheric surface. Moreover, the 2nd lens plate 1102 has two or more single lens sections of the same configuration as the 1st lens plate 203 in the operation gestalt of drawing 10 .
[0069] And the core of the convex of each single lens section of the 1st lens plate 1103 and the core of each single lens section of this and the 2nd lens plate 1102 corresponding to 1 to 1 are constituted so that it may stand in a line in the shape of about 1 straight line to the core of 2-dimensional light modulation equipment 106, therefore the size of the 2nd lens plate 1102 is smaller than the size of the 1st lens plate 1103 like illustration.
[0070] also according to the operation gestalt of this drawing 11 , there is no difference in the function to obtain and to say the laser flux of light to the display of 2-dimensional light modulation equipment like the semiconductor laser light equipment shown in drawing 2 and drawing 10 if transfer superposition is carried out in any way, and a bright uniform projection image can be acquired.
[0071] In addition, the opening configuration of the single lens section which constitutes the 2nd lens plate 1102 does not necessarily need to be a rectangle, and as long as there is no possibility that the laser flux of light condensed with the 1st lens plate 1103 may be kicked, what kind of configuration is sufficient as circular, three square shapes, six square shapes, etc.
[0072] Moreover, the 1st lens plate 1103 may consist of drawing 11 towards the semiconductor laser array 201 side, although the convex has turned to the 2-dimensional light modulation equipment 106 side the field formed in the shape of a matrix.
[0073] Here, the integrator generally used for an exposure machine etc. as optical system which has two lens plates explained above is suitable, and, for details, JP,3-111806,A has detailed explanation, for example.
[0074] As mentioned above, although blue semiconductor laser light equipment 103 was explained, as described above, it is the same configuration as the above-mentioned blue semiconductor laser light equipment 103 except using the thing corresponding to the color to which the wavelength of output light is equivalent as semiconductor laser which is the light source about the red semiconductor laser light equipment 101 in the operation gestalt of drawing 1 , and green semiconductor laser light equipment 102.
[0075] In addition, as red semiconductor laser, the thing of an InGaN system or a ZeSe system can be used as an InGaN system and green semiconductor laser as an AlGaInP system and blue semiconductor laser.
[0076] Therefore, according to the above operation gestalt, since the laser light from two or more semiconductor laser is compounded and used as illumination light, the projection image of sufficient brightness can be obtained easily. Moreover, since the cross-section configuration of the laser flux of light group after composition is made to the same configuration as the display of 2-dimensional light modulation equipment, high lighting of the effectiveness which does not have excess and deficiency using two or more semiconductor laser can be performed. That is, since there is almost no loss of the light by the mismatch of the illumination light and the configuration of the display of 2-dimensional light modulation equipment, efficiency for light utilization is high and a bright projection image is acquired. Furthermore, since luminous-intensity distribution of the laser flux of light group after composition is made to homogeneity, the high-definition projection image which does not have unevenness in the brightness in an image is acquired.
[0077] By the way, by the light source (mainly metal halide lamp) used for the projection mold display by the conventional technique, as already explained, since the flux of light outputted was unpolarized light, in TN liquid crystal display component suitable as 2-dimensional light modulation equipment etc., a half light was absorbed with the polarizing plate arranged at an incidence side.
[0078] However, in the projection mold display of this invention, linearly polarized light light is outputted from each semiconductor laser, therefore the light absorption by the polarizing plate can be small suppressed by arranging the sense of the polarization so that it may become parallel to the polarization shaft of the polarizing

plate arranged at the incidence side of TN liquid crystal display component. Therefore, according to the above-mentioned operation gestalt, the use effectiveness of light improves further and a brighter projection image is acquired easily.

[0079] Moreover, since degradation of the temperature rise by the light absorption of a polarizing plate and the polarizing plate accompanying this can also be controlled as a result, a high-definition projection image can be acquired over a long period of time. Furthermore, although cures, such as installation of UV and IR cut-off filter, were required of the light source of the conventional technique since ultraviolet rays and infrared radiation were included in output light, in semiconductor laser, these cures are unnecessary, therefore according to the operation gestalt of above-mentioned this invention, a configuration becomes easy.

[0080] Moreover, a high light of color purity with a narrow wavelength band is obtained from semiconductor laser. Therefore, according to the operation gestalt of this invention, a high-definition projection image with the wide color reproduction range can be acquired easily.

[0081] Next, other operation gestalten of the projection mold display by this invention are explained. First, drawing 12 is the 2nd operation gestalt of the projection mold display by this invention, and as a fundamental configuration, it connects with 2-dimensional light modulation equipment 1203 and semiconductor laser light equipment 1201 by the cable at semiconductor laser light equipment 1201, 123 or 2-dimensional field lens light modulation equipment 1203, a projector lens 108, and it, and this operation gestalt is equipped with the image control unit 1205 which controls these [ both ], and it is constituted so that a full color image may be projected on a screen 109.

[0082] The point which only differ and consists of a collimator lens array 202, the 1st lens plate 1209, and the 2nd lens plate 1001 has [ the semiconductor laser light equipment 103 which explained the optical system of semiconductor laser light equipment 1201 by drawing 10 ] the the same semiconductor laser array 1207. In addition, the 1st lens plate 203 and function of drawing 10 of the 1st lens plate 1209 are the same here.

[0083] Therefore, the point of the laser flux of light group which carried out incidence to each single lens section which constitutes the 1st lens plate 1209 which is superimposed on the display of 2-dimensional light modulation equipment 1203 through the 2nd lens plate 1001 and field lens 123, and serves as illumination light of uniform optical reinforcement is the same as the operation gestalt of drawing 10 .

[0084] The semiconductor laser array 1207 is equipped with at least three kinds of semiconductor laser components which emit light in the colored light equivalent to the three primary colors, and it is constituted so that 2-dimensional light modulation equipment 1203 may be irradiated by control of the image control unit 1205, changing red and each green and blue laser light. And according to the image information similarly supplied from the image control unit 1205, it will become irregular, and expansion projection of the flux of light by which did in this way and incidence was carried out to 2-dimensional light modulation equipment 1203 will be carried out with a projector lens 108 as it is at a screen 109.

[0085] In order to acquire a full color image, therefore, 2-dimensional light modulation equipment 1203 When a red laser light is irradiated, red image data is displayed. It is necessary to repeat the actuation which displays green image data when a green laser light is irradiated, and displays image data blue when a blue laser light is irradiated. This sake, Time-sharing actuation of the 2-dimensional light modulation equipment 1203 of one sheet must be carried out, and the image of red and each green and blue color must be operated with the so-called field serial mode which carries out sequential projection.

[0086] Then, 2-dimensional light modulation equipment 1203 and the semiconductor laser array 1207 are connected to the image control unit 1205, respectively, and luminescence of the semiconductor laser of each color and the timing of a display (modulation) of 2-dimensional light modulation equipment 1203 are doubled.

[0087] In this case, although the quick thing of an optical response is needed since red, green, and the blue image of three frames must be displayed between the one-frame periods in the usual picture signal, these should just be used for it, 2-dimensional light modulation equipment's 1203 having a ferroelectric liquid crystal display device and an antiferroelectricity liquid crystal display component, and choosing them as equipment which suits this purpose.

[0088] Next, the semiconductor laser light equipment 1201 which is the principal part in this operation gestalt is explained. Drawing 13 is 1 operation gestalt of this 1st lens plate 1209, and the cross-section configuration 1301 (R, G, B, X) of the laser flux of light group on this lens plate 1209 is indicated for explanation. And the part of this operation gestalt in which the 1st lens plate 1209 is formed in two longitudinal directions, two lengthwise directions, and a total of four single lens sections serves as a unit field for homogeneity lighting in this case by the case of multiplier Nh=Nv=Kh=Kv=2.

[0089] Therefore, every direction puts two units of this unit field in order at a time, it is made the number of four units and the single lens section, the 1st lens plate 1209 is formed of a total of 16 single lens sections, and the laser flux of light of a different color for every unit field of this comes to be irradiated, consequently the laser flux of light of each color serves as illumination light which has uniform optical intensity distribution in a field in 2-dimensional light modulation equipment 1203 display.
[0090] By the way, with the operation gestalt shown in this drawing 13 , the unit field is irradiating [ unit field 1209R ] red laser flux of light group 1301R and blue laser flux of light group 1301B to unit field 1209B to laser flux of light group 1301G [ green ] those with four piece, and unit field 1209G at the 1st lens plate 1209. So, to the remaining unit field 1209X, if it is made to irradiate the laser light of a color with few amounts of luminescence among red and each green and blue semiconductor laser flux of light group, even if an engine-performance difference is in the semiconductor laser of each color, it can be compensated and more uniform lighting can be obtained.
[0091] Moreover, you may make it irradiate this laser light at unit field 1209X using the semiconductor laser which emits the laser light which has the 4th different main wavelength from the three primary colors according to an application. In this case, although frame frequency must be increased 4 times over the past, the reappearance range of a color can acquire breadth and a more nearly high-definition projection image. In addition, the number of the unit fields which constitute the 1st lens plate 1209 may be made into the multiple of 3, and you may make it a configuration so that the laser flux of light in three primary colors may pass through the unit field of the respectively same number.
[0092] Drawing 14 is 1 operation gestalt of the semiconductor laser array 1207, it is constituted by two or more semiconductor laser components arranged in the shape of a matrix, and the semiconductor laser component which emits the laser light of a specific color is arranged in this case corresponding to each of four fields.
[0093] That is, the semiconductor laser component to which blue semiconductor laser component 1401B emits [ red semiconductor laser component 1401R ] the laser light in which green semiconductor laser component 1401G have the 4th main wavelength which is different from the semiconductor laser component of one kind of a certain color in red, green, and blue or the three primary colors to field 1207X in it to field 1207G is arranged at field 1207B at field 1207R, respectively.
[0094] And this semiconductor laser array 1207 acquires a color image by carrying out sequential luminescence only of the semiconductor laser of the field where the semiconductor laser component of a desired color has been arranged by control of the image control unit 1205 according to the color of the image displayed with 2-dimensional light modulation equipment 1203 (modulation), and the timing of a display, and carrying out expansion projection of the light modulated with 2-dimensional light modulation equipment 1203 with a projector lens 108 at a screen 109.
[0095] Therefore, since the laser light from two or more semiconductor laser is compounded and used also according to the operation gestalt of this drawing 12 , the operation effectiveness equivalent to the operation gestalt explained by drawing 1 -- a projection image can be obtained -- and drawing 2 of sufficient brightness can be acquired.
[0096] Moreover, since the configuration of optical system is simplified, miniaturization of equipment and low cost-ization can be attained, since according to the operation gestalt of this drawing 12 a full color display is obtained by the 2-dimensional light modulation equipment 1203 of one sheet and color composition means, such as a dichroic prism, become unnecessary, and convergence adjustment becomes unnecessary further, maintenance check becomes easy and can fully raise dependability.
[0097] Moreover, since the wavelength band uses the semiconductor laser which can obtain a narrow high light of color purity as the light source according to the operation gestalt of this drawing 12 , When a high-definition projection image with the color reproduction range wider than the case where the source of the white light is used like the conventional technique can be acquired, Furthermore, since the semiconductor laser which emits the laser light which has the 4th different main wavelength from semiconductor laser in three primary colors can be arranged, the reappearance range of a color can be extended further and a more nearly high-definition projection image can be acquired easily.
[0098] In addition, what is necessary is for a potato to be good and just to apply the incident light study system of a well-known clinch method in this case with the operation gestalt of this drawing 12 , using the display device of the reflective mold in which high-speed modulations, such as DMD (Digital Micromirror Device), are possible, although the liquid crystal display component of a transparency mold was used as 2-dimensional light modulation equipment.

[0099] Next, drawing 15 is 1 operation gestalt when the 2-dimensional light modulation equipment of a reflective mold constitutes this invention. Like illustration near the three side faces which become the optical incidence side of a dichroic prism 107 The polarization beam splitter 1512 for blue is added to the polarization beam splitter 1510 for red, the polarization beam splitter 1511 for green, and it. Furthermore, the 2-dimensional light modulation equipment 1504 for reflective mold red and the 2-dimensional light modulation equipment 1505 for reflective mold green are formed, the 2-dimensional light modulation equipment 1506 for reflective mold blue is formed in it near the side face of the opposite side of these polarization beam splitter, and other points are the same as the operation gestalt of drawing 1 .

[0100] The liquid crystal display which forms a mirror for example, on a semiconductor chip, uses the ECB (Elecrically Contorlledbirefringence) effectiveness indicated by the liquid crystal display component of the reflective mold incorporating liquid crystal, for example, JP,64-7021,A, controls a polarization condition, and forms an image is suitable for the 2-dimensional reflective mold light modulation equipments 1504, 1505, and 1506 of each color.

[0101] Drawing 18 is the sectional view showing the basic configuration of this ECB reflective mold liquid crystal display component, first, the top substrate 1801 consists of glass substrates 1804 with which a transparent electrode 1802 and the orientation film 1803 were formed, and the laminating of the phase plate 1805 is carried out to the close outgoing radiation side of that light. On the other hand, on the silicon substrate 1807, the bottom substrate 1806 carries out sequential formation of the orientation film 1811, and is constituted by MOSFET1808, a wiring layer 1809, the aluminum electrode layer 1810 that served both as the reflecting plate, and it.

[0102] And liquid crystal 1812 is enclosed between these top substrate 1801 and the bottom substrate 1806, and it changes according to the electrical potential difference to which the direction of orientation of this liquid crystal 1812 is impressed inter-electrode [ up-and-down ], and it is constituted so that it can control continuously between the 1st direction of orientation, and the 2nd direction of orientation almost perpendicular to this.

[0103] Next, about actuation of the operation gestalt of this drawing 15 , green optical system is made into representation and explained. Drawing 16 is the basic block diagram showing some projection mold displays shown in drawing 15 , and green semiconductor laser light equipment 102 is constituted from the 2nd lens plate 1001 by the green semiconductor laser array 1601, the collimate lens array 202, the 1st lens plate 203, and it, and constitutes the above-mentioned semiconductor laser light equipment (for example, drawing 10 ) and the optical system which has the same function with the same configuration fundamentally.

[0104] And after laser light outputted from the semiconductor laser array 1601 is made parallel by the collimate lens array 202, incidence of it is carried out to a polarization beam splitter 1511 through the 1st lens plate 203 and the 2nd lens plate 1001. At this time, the direction of the linearly polarized light of the laser light outputted from each semiconductor laser component of the semiconductor laser array 1601 is arranged in the direction which serves as S polarization to polarization separation side 1511G of a polarization beam splitter 1511, and almost all the laser flux of light is made to be reflected by polarization separation side 1511G.

[0105] The green polarization beam splitter 1511 is the prism optical element of 4 prismatic forms in which the polarization demarcation membrane which has the polarization separation property shown in drawing 17 was formed to the plane of composition of the prism of 3 prismatic forms, the field lens 122 and the 2-dimensional reflective mold light modulation equipment 1505 for green are arranged on polarization separation side 1511G of this polarization beam splitter 1511, and the side face which counters, and green semiconductor-laser light equipment 102 is arranged near the side face which adjoins each other with this as illustration.

[0106] Consequently, the laser flux of light reflected by polarization separation side 1511G Incidence is carried out to 2-dimensional light modulation equipment 1505 through the field lens 122. At this time The laser flux of light group which passed each single lens section which constitutes the 1st lens plate 203 like the above-mentioned operation gestalt Through the 2nd lens plate 1001, and the polarization beam splitter 1511 for green and the field lens 122, it will be transmitted to the display of the 2-dimensional reflective mold light modulation equipment 1505 for green the neither more nor less, and will be superimposed, and bright uniform lighting will be obtained.

[0107] The value of the retardation given by the laminating of a phase plate 1805 and the liquid crystal layer 1812 is changing between -(2m-1) lambda/4, and m-lambda/2, and 2-dimensional light modulation equipment 1505 performs the modulation according to image information, when the direction of orientation of liquid crystal changes and main wavelength of incoming beams is set to lambda with the electrical potential difference

impressed between vertical substrates as shown in drawing 18 . Here, m is an integer.
[0108] Namely, the flux of light which carried out incidence to the pixel whose value of the retardation at the time of carrying out the laminating of the liquid crystal layer 1812 to a phase plate 1805 is -(2m-1) lambda/4 After reflection becomes the linearly polarized light rotated 90 degrees to the linearly polarized light which carried out incidence in order that lambda/2 of phase contrast might stick, consequently become P polarization to polarization separation side 1511G of a polarization beam splitter 1511, and polarization separation side 1511G are penetrated. Expansion projection will be carried out through a dichroic prism 107 and a projector lens 108 at a screen 109, and clear display is obtained at this time.
[0109] After reflection, since the flux of light which carried out incidence to the pixel whose values of the retardation at the time of carrying out the laminating of the liquid crystal layer 1812 to a phase plate 1805 are m-lambda/2 (m) on the other hand will be in the same condition as the time of incidence, it is again reflected by polarization separation side 1511G and incidence of it is not carried out to a projector lens 108, it serves as a dark display at this time.
[0110] What is necessary is here, to arrange the polarizing plate which absorbs the linearly polarized light component which serves as P polarization to polarization separation side 1511G on the side face by the side of the semiconductor laser light equipment 102 of a polarization beam splitter 1511, or just to arrange the polarizing plate which absorbs the linearly polarized light component which serves as S polarization to polarization separation side 1511G between a polarization beam splitter 1511 and a dichroic prism 1513, in order to realize a higher contrast ratio.
[0111] Although the above is explanation about green optical system, the modulation according to image data is similarly performed about other colors. Therefore, although it is the configuration same about the 2-dimensional reflective mold light modulation equipment 1504 for red, and the 2-dimensional reflective mold light modulation equipment 1506 for blue as the ECB reflective mold liquid crystal display component fundamentally shown in drawing 18 So that the retardation value at the time of carrying out the laminating of a phase plate 1805 and the liquid crystal layer 1812 to the main wavelength lambda of incoming beams by suitable electrical-potential-difference within the limits which can be impressed to a liquid crystal layer can realize -(2m+1) lambda/4, and m-lambda/2 It is desirable to change the thickness of a liquid crystal ingredient and a liquid crystal layer or the phase contrast of a phase plate for every color.
[0112] On the other hand, about red semiconductor laser light equipment 101 and blue semiconductor laser light equipment 103, it is good as a semiconductor laser component which is the light source with the same configuration as the above-mentioned green semiconductor laser light equipment 102 except using the thing corresponding to the color to which the wavelength of output light is equivalent.
[0113] Moreover, in the wavelength band of the laser light corresponding to each color in the spectral characteristic [ in / the basic configuration of the polarization beam splitter 1510 for red and the polarization beam splitter 1512 for blue is the same as that of a polarization beam splitter 1511, and / a polarization separation side ], sufficient extinction ratio should just be obtained by S polarization and P polarization.
[0114] So, with the operation gestalt of drawing 15 , after being reflected in respect of polarization separation of polarization beam splitters 1510, 1511, and 1512, respectively, incidence of red semiconductor laser light equipment 101, green semiconductor laser light equipment 102, and the laser light of each color outputted to it from blue semiconductor laser light equipment 103 will be carried out to the display of the 2-dimensional reflective mold light modulation equipments 1504, 1505, and 1506 the neither more nor less, and they will be irradiated so that the optical reinforcement within a field may become homogeneity.
[0115] And with the 2-dimensional light modulation equipment of each color, the modulation according to the image information of each color is performed, incidence of the modulation light of each color is carried out to a dichroic prism 107, henceforth, like the operation gestalt of drawing 1 , expansion projection will be carried out on a screen 109 with a projector lens 108, and a full color image will be acquired.
[0116] Therefore, since the laser light from two or more semiconductor laser is compounded and used also according to the operation gestalt of this drawing 15 , the operation effectiveness equivalent to the operation gestalt explained by drawing 1 -- a projection image can be obtained — and drawing 2 of sufficient brightness can be acquired.
[0117] As described above, by the way, the light source of the metal halide lamp used with the projection mold display by the conventional technique Although only a half light has been used when an ECB reflective mold liquid crystal display component suitable as 2-dimensional reflective mold light modulation equipment was used since the flux of light outputted was unpolarized light By arranging the direction of the linearly polarized light of

the laser light outputted from semiconductor laser in the direction which serves as S polarization to the polarization separation side of a polarization beam splitter according to the projection mold indicating equipment of this invention shown in this drawing 15 Almost all laser light can be used for projection, consequently efficiency for light utilization can improve further, and a brighter projection image can be acquired.

[0118] Moreover, when the 2-dimensional light modulation equipment of such a reflective mold is used, the effective area which can be used for a display rather than the above-mentioned transparency mold liquid crystal display component spreads. That is, with the liquid crystal display component of a transparency mold, although neither the wiring section nor a TFT part can let light pass, since wiring etc. can form also in the bottom of a picture element part, i.e., a reflector, it can enlarge display effective area more in the liquid crystal display component of a reflective mold. Therefore, as compared with the case where a transparency mold liquid crystal display component is used, a brighter projection image can be obtained by adopting a reflective mold liquid crystal display component like the operation gestalt of this drawing 15 .

[0119] by the way -- although it is used in the projection mold display using the light source of the conventional metal halide lamp etc. after carrying out the spectrum of the white light outputted from the light source to the three primary colors with a dichroic mirror etc. -- this time -- such a source of the white light -- the spectrum of output light -- since a spectrum is broadcloth, in order to use light source light efficiently, as described above, it is necessary to make the wavelength band of each colored light large as much as possible

[0120] However, when the large colored light of a wavelength band is used for an ECB reflective mold liquid crystal display component suitable as 2-dimensional reflective mold switching equipment, if the electrical potential difference impressed to a liquid crystal layer for the wavelength dispersion of a liquid crystal layer and a phase plate is changed, a color gap will arise. That is, the problem that a chromaticity will change with brightness will arise in this case.

[0121] however, inside, according to this invention, since semiconductor laser with the narrow wavelength band of output light is used as the light source, it is hardly generated but such a color gap can obtain a high-definition projection image.

[0122] Furthermore, the polarization separation property of a polarization beam splitter required for the display by the ECB reflective mold liquid crystal display component can carry out polarization separation efficiently only in a quite narrow wavelength band as it was generally shown in drawing 17 . For this reason, in the conventional light source, it needed to be used, having lowered use effectiveness or the more expensive polarization beam splitter needed to be used. However, according to this invention, since semiconductor laser with the narrow wavelength band of output light is used, a polarization beam splitter can be used efficiently and a bright projection image can be obtained.

[0123] In addition, although the above-mentioned operation gestalt explained the case where the ECB reflective mold display of three sheets was used as 2-dimensional reflective mold light modulation equipment, you may carry out as equipment of a reflective mold with the 2-dimensional light modulation equipment of one sheet shown in drawing 12 , using an ECB reflective mold liquid crystal display component as 2-dimensional light modulation equipment in the operation gestalt which performs a full color display.

[0124] Next, still more nearly another operation gestalt of this invention is explained. With the operation gestalt explained until now, two lens plates were used for semiconductor laser light equipment. However, according to this invention, also with one lens plate, the purpose can be attained, equivalent effectiveness can be acquired, and the operation gestalt of this invention using [ therefore ] this one lens plate is explained hereafter.

[0125] In addition, also with the operation gestalt explained below, the whole configuration is the same as the operation gestalt of drawing 1 , and since the configurations of each semiconductor laser light equipment 101, 102, and 103 only merely differ, these semiconductor laser light equipment 101, 102, and 103 is explained hereafter. In addition, these of the configuration of the whole optical system are the same, and since the luminescent color of the semiconductor laser used as the light source only differs, like the time of drawing 2 , by the following explanation, blue semiconductor laser light equipment 103 is mentioned as an example, and they explain it.

[0126] Everything but the light source section by which blue semiconductor laser light equipment 103 was constituted from a semiconductor laser array 201 and a collimate lens array 202 is constituted from this operation gestalt by only the 1st lens plate 1901 arranged between the field lens 123 and the light source section so that clearly from drawing 19 .

[0127] It is what was equipped with two or more single lens sections in the perpendicular field to the main shaft 1902 of the laser flux of light group which this 1st lens plate 1901 was outputted from the semiconductor laser

array 201, and was made parallel by the collimate lens array 202. A focal distance and center of curvature are specified for every single lens section, and this 1st lens plate 1901 is hereafter explained to a detail so that the transfer superposition of the laser flux of light group which carried out incidence to each single lens section can be carried out by this at the display of 2-dimensional light modulation equipment 106.

[0128] This 1st lens plate 1901 is equipped with the four single lens sections 2001, 2002, 2003, and 2004 which have the same focal distance in the shape of a matrix, as shown in drawing 20 . And each of these single lens section 2001- is made by the display of 2-dimensional light modulation equipment 106, and the similar rectangle.

[0129] Further and these single lens section 2001- It is made from the so-called decentered lens which has the center of curvatures 2001c, 2002c, 2003c, and 2004c of a lens convex in a location different, respectively. The location of the center of curvature It is parallel to the main shaft of the optical system of semiconductor laser light equipment 103, and is made to have come [ from the medial axis 1902 passing through the display core of 2-dimensional light modulation equipment 106 ] to the location where only Y shifted in X and the height direction crosswise as illustration, respectively.

[0130] Here, if the ratio of X and Y will also be set to 4:3, X:Y=4:3 [ i.e., ], according to this supposing the width of face of the display of 2-dimensional light modulation equipment 106 and the ratio of height are 4:3, the ratio of width of face and height can lay the flux of light which passed each single lens section 2001- the neither more nor less on top of the rectangle configuration of 4:3.

[0131] Moreover, if each single lens section 2001 - a focal distance are set to f and distance of the 1st lens plate 1901 and 2-dimensional light modulation equipment 106 is set to L, the magnitude of the cross section of the flux of light which passed each single lens section 2001- will become /f time mostly (L-f) on 2-dimensional light modulation equipment 106. Therefore, based on this relation, each single lens section 2001 - a focal distance can be determined from the relation of each single lens section 2001 which constitutes the 1st lens plate 1901 - magnitude, and the magnitude of the display of 2-dimensional light modulation equipment 106.

[0132] Consequently, the magnitude of the single lens section of the 1st lens plate 1901 in case the transfer superposition of the flux of light which passed each single lens section 2001- of the 1st lens plate 1901 is carried out on the display of 2-dimensional light modulation equipment 106, About the relation of the pitch of a laser flux of light group which carries out incidence to this, it becomes the same as the operation gestalt at the time of using the two above-mentioned lens plates, therefore is only the 1st lens plate 1901, and the same function as the case where two lens plates are used will be obtained.

[0133] Therefore, since the laser light from two or more semiconductor laser is compounded and used also according to the operation gestalt of this drawing 19 , the operation effectiveness equivalent to the operation gestalt explained by drawing 1 -- a projection image can be obtained -- and drawing 2 of sufficient brightness can be acquired. That is, also in the operation gestalt of this drawing 19 , since the laser light from two or more semiconductor laser is compounded and used as illumination light, the projection image of sufficient brightness can be obtained.

[0134] The sense of polarization of the linearly polarized light light outputted from each semiconductor laser also according to the operation gestalt of this drawing 19 by the way, by arranging so that it may become the desired polarization direction in the display device using polarization of TN liquid crystal display component etc. Although the light absorption by a polarizing plate etc. can be suppressed small, consequently efficiency for light utilization will improve further and a brighter projection image will be acquired Here, further, with this operation gestalt, since a lens plate is an one-sheet deer from semiconductor laser before 2-dimensional light modulation equipment, a possibility that that part and a polarization condition may be disturbed becomes small, and a still brighter projection image can be obtained.

[0135] Moreover, since components mark become fewer rather than the case where two lens plates are used according to the operation gestalt of this drawing 19 , it is effective in lightweight-izing and low cost-ization being obtained.

[0136]

[Effect of the Invention] According to this invention, since the laser flux of light from two or more semiconductor laser can be compounded and used as illumination light, the projection image of sufficient brightness can be acquired easily. Moreover, according to this invention, since the display of 2-dimensional light modulation equipment is overlapped on the laser flux of light from two or more semiconductor laser the neither more nor less, there is almost no loss of the light by the mismatch with the configuration of the display of 2-dimensional light modulation equipment, for this reason, the use effectiveness of light is high and a bright

projection image can be acquired.

[0137] Furthermore, according to this invention, since the laser flux of light group after composition becomes uniform optical intensity distribution, the high-definition projection image which does not have unevenness in brightness can be acquired easily. On the other hand, since the sense of polarization of the linearly polarized light light outputted from each semiconductor laser can be arranged towards desired according to this invention, when a liquid crystal display component suitable as 2-dimensional light modulation equipment is used, loss by a polarizing plate etc. can be suppressed small, therefore the use effectiveness of light can improve greatly, and a brighter projection image can be acquired. Moreover, since a high light of color purity with a narrow wavelength band is obtained, according to this invention, the color reproduction range becomes large rather than the case where the source of the white light of the conventional technique is used, consequently the semiconductor laser which is the light source can acquire a projection image high-definition enough.

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[Translation done.]

* NOTICES *



1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

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DRAWINGS

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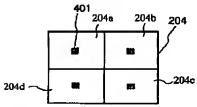
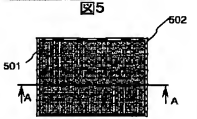
[Drawing 4]

図4



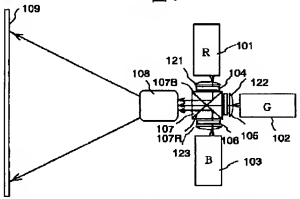

[Drawing 5]

図5




[Drawing 1]

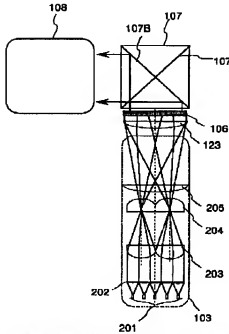
図1




１０１：赤色半導体レーザー光源装置（Ｒ）
１０２：緑色半導体レーザー光源装置（Ｇ）
１０３：青色半導体レーザー光源装置（Ｂ）
１０４：赤色用二次元光変調装置
１０５：緑色用二次元光変調装置
１０６：青色用二次元光変調装置
１０７：ダイクロイックプリズム
１０８：投射レンズ
１０９：スクリーン
１２１，１２２，１２３：フィールドレンズ

[Drawing 2]

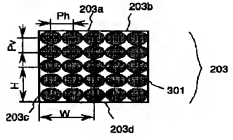
図2




103：青色半導体ﾚｰｻﾞｰ光源装置(B)　201：半導体ﾚｰｻﾞｰｱﾚｲ
107：ﾀﾞｲｸﾛｲｯｸﾌﾟﾘｽﾞﾑ　202：ｺﾘﾒｰﾄﾚﾝｽﾞｱﾚｲ
108：投射ﾚﾝｽﾞ　203：第1のﾚﾝｽﾞ板
109：ｽｸﾘｰﾝ　204：第2のﾚﾝｽﾞ板
123：ﾌｨｰﾙﾄﾞﾚﾝｽﾞ　205：第3のﾚﾝｽﾞ板

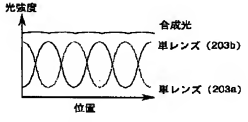
[Drawing 3]

図3



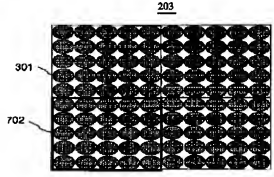

[Drawing 6]

図6



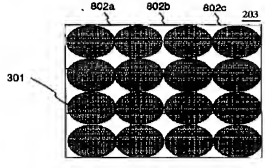

[Drawing 7]

図7



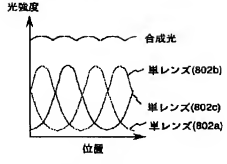

[Drawing 8]

図8



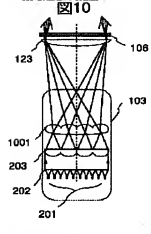

[Drawing 9]

図9



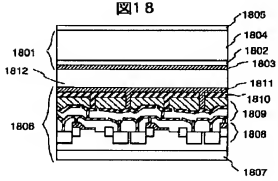

[Drawing 10]

図10



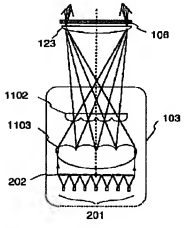

[Drawing 18]

図18



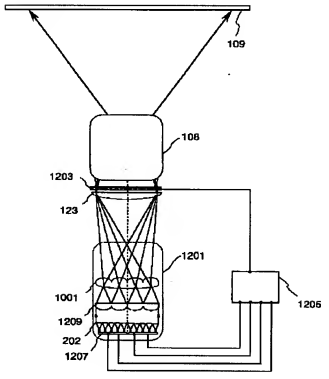

[Drawing 11]

図11



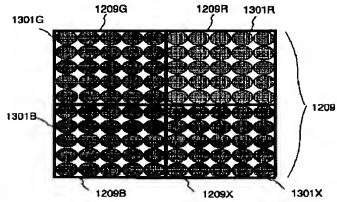

[Drawing 12]

図12



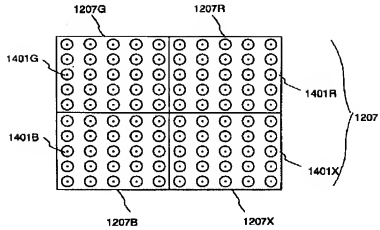

[Drawing 13]

図１３



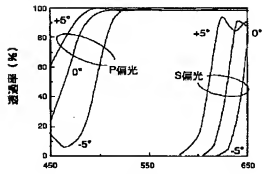

[Drawing 14]

図１４




[Drawing 17]

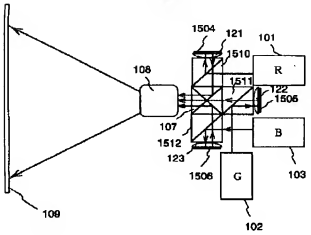
図１７




偏光ビームスプリッタの特性

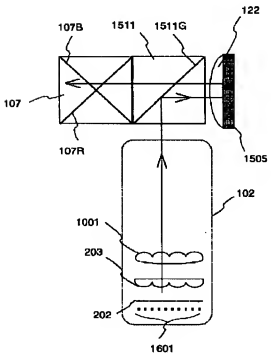
[Drawing 15]

図15



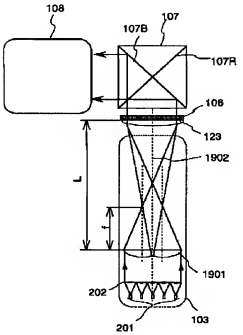

[Drawing 16]

図16



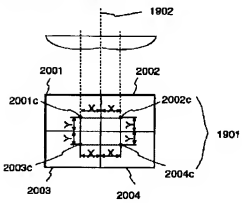

[Drawing 19]

図19




[Drawing 20]

図20

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[Translation done.]